are certainly true females, and that the reproductive bodies more nearly resemble eggs than gemmæ in their origin and development. Hereafter, however, it may be convenient to give a separate name to those egg-like bodies, which are fertile without impregnation, but for the present they must be called eggs.

The author then gives a list of the instances of Parthenogenesis which, so far as he knows, are recorded among the Articulata. Finally, he expresses the belief that the careful consideration of these cases, and of the facts now recorded as to *Daphnia*, and the still more wonderful observations recently detailed by Siebold in regard to *Apis* (if these latter are confirmed), must surely remove all lingering doubts as to the identity between eggs and buds; and remarks, that if Prof. Huxley's definition of "individual" and "zooid" is to be adopted, it will be impossible to assert of any Daphnia or Moth, whether it is the one or the other, and the Hive-bee will have to be considered as an hermaphrodite, a species without male individuals.

Under these circumstances, the author suggests that it would be more convenient to continue, as heretofore, to call the individual of any species that which is individualized, even though in this case the individuals of one species will not always be homologous with those of another.

BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY.

November 13, 1856.—W. E. Frere, Esq., C.S., President, in the chair.

"Transformation of the Vegetable Protoplasm into *Actinophrys*." By H. J. Carter, Esq., Assistant Surgeon H.C.S. Bombay.

The author stated, that when he first entered upon the study of the Infusoria and freshwater Algæ, he had no idea of any union existing between the two, further than that of a gradual approximation of form and organization: and that he was opposed to any sudden leaps from the animal into the vegetable kingdom or *vice versâ*, might be seen by the facts which he had brought forward, in attempting to account for the transformation that takes place in the *Characeæ* when the contents of their cells undergo the changes which he had described on a previous occasion (Annals, vol. xvii. p. 101, &c.). But latterly his opinions had altered, and he was now compelled to view these transformations as a direct passage of the protoplasm into Monads.

The process which ends in this development had been called by Nägeli "abnormal cell-formation," and Nägeli thought that in some instances germs were thus produced which propagated the plant. Nor could Pringsheim come to any other conclusion than that they were reproductive in *Spirogyra*, where he had more particularly observed them; while the philosophic Alexander Braun, after recapitulating all that had been made known on the subject in his 'Rejuvenescence in Nature,' adds, "the future will certainly unfold many interesting phænomena in this hitherto little-worked field."

Before detailing his observations on this development in *Spirogyra*

which had led to the view above mentioned, the author had thought proper to premise a short account of analogous transformations in *Vorticella* and *Euglena*. In confirming most of what Stein had stated, respecting the passage of *Vorticella* into *Acineta*, he observed, that he had never seen the young of the latter assume any other form than that of *Acineta*, but he had witnessed *Amœbæ* in the act of throwing off living *Vorticellæ*. The passage of the contents of *Euglena* (which organism was much more allied to the vegetable than the animal kingdom) into Rhizopods was a common occurrence, and so nearly resembling that which takes place in *Spirogyra*, that it formed a good transitional link, perhaps, between the passage of *Vorticella* on the Infusorial, and the contents of the cell of *Spirogyra*, on the Alga side, into Rhizopodous animalculæ.

It was in the cell of *Spirogyra crassa* (Kg.) (the largest perhaps of the genus), however, that Mr. Carter had latterly been watching these transformations, and it was to these more particularly that he wished to direct attention. The process was simply this :—

Under certain circumstances the cell of *Spirogyra* apparently dies, the chlorophyll becomes yellow, and the protoplasm leaving its natural position divides up into portions of different sizes, each of which encloses more or less of the chlorophyll; these portions travel about the cell under a Rhizopodous form, the chlorophyll within them turns brown, the portions of protoplasm then become Actinophorous, then more radiated, and finally assume the figure of *Actinophrys*. The radii are now withdrawn, while the pellicula in which they were encased is retracted and hardened into setæ with the rest of the pellicula, which now becomes a lifeless transparent cyst; another more delicate cyst is secreted within this, and the remains of the protoplasm within all having separated itself from the chlorophyll, divides up into a group of monociliated Monads, which sooner or later find their way through the cysts into the cell of the *Spirogyra*; while the latter by this time having passed far into dissolution (not putrefactive), they thus easily escape into the water. Putrefactive decomposition at the commencement destroys this process altogether.

At first it did not appear plain why the portions of protoplasm enclosed the chlorophyll, but afterwards it was found that this was for the purpose of abstracting the starch which accompanies the latter, since in some cases where the grains of starch were numerous the chlorophyll was not included.

This was the process when the cells of *Spirogyra* were not pregnant with starch, as they are just before conjugating. When these changes took place at this period they were somewhat different, insomuch as the whole of the contents of the two conjugating cells become united into one mass, and having assumed a globular form, remain in this state until the chlorophyll has become more or less brown. After this the protoplasm reappears at the circumference of the mass in two forms, viz. in portions which leave the mass altogether after the manner of Rhizopods, and in the form of tubular extensions which maintain their connexion with the mass throughout. In both instances the protoplasm is without chlorophyll, but charged with oil-

globules, and both forms make their way to the confines of the *Spirogyra*-cell, which they ultimately pierce, develope their contents, and discharge them in the following manner:—

On reaching the cell-wall, each form puts forth a minute papillary eminence, which, having passed through the wall, expands into a large sac, or bursts at its apex. Following the isolated form first, this then gradually drags four-fifths or more of its bulk through this opening, sometimes so much as only to leave a little papillary eminence in it, which then makes the portion of protoplasm look as if it were entering instead of escaping from the *Spirogyra*-cell; the internal contents of this protoplasm then become more defined and granular, the granules assume a spherical form respectively, they evince a power of locomotion, and the originally flexible pellicula having become a stiffened cyst, with a more delicate one within (as in the process already detailed), assumes a slightly conical form, which giving way by a circular aperture at the apex, allows the granules to pass into the water, when they are seen to be monociliated Monads; each consisting, apparently, of a film of protoplasm expanded over an oil-globule, and bearing a single cilium. The contents of the tubular form, on the other hand, undergo the same changes, but the tube becomes dilated into a pyriform shape within the *Spirogyra*-cell; and when the Monads are ready to lead an independent existence, the end of the papillary eminence, which has been projected some little distance beyond the cell-wall into the water, gives way, and thus they also escape.

In another form of this tubular extension, the inner delicate cyst expands into a flask-like or globular shape, beyond the papillary eminence, outside the cell-wall, and retains the protoplasmic contents here until they are ultimately developed into Monads. These, which are much larger than the Monads developed by the other processes, on issuing, move about rapidly for some time by the aid of a strong cilium carried in front like that of *Astasia*, and then become stationary; the vesicula or "contracting vesicle," which does not appear before they leave the cyst, now becomes very active, the cilium is gradually diminished in size and altogether disappears, and the Monad passes into a Rhizopodous, reptant state, which afterwards becomes Actinophorous, and finally assumes a form undistinguishable from that of *Actinophrys Sol*.

Up to this point the author had been able to follow this transformation, and although he had not actually seen the Actinophorous form enclose particles of food, yet he deemed the form itself sufficiently significant to guarantee this induction, since he had never witnessed a Rhizopod of the kind without attacking everything living and dead that it could overcome and turn into nourishment; besides, such a form could obtain sustenance in no other way. If this was not satisfactory, it was not difficult to conceive, that what the portions of protoplasm in an Actinophorous form would do within, they would do outside the cell of *Spirogyra*; and it had been shown, in the first process detailed, that inside the cell they enclosed chlorophyll, and finally ejected the refuse in the manner of *Amœba*. Lastly, the Monads which are developed by a similar process in the *Characeæ* are fre-

quently seen to issue from the cysts with portions of the brown chlorophyll in their interior, which, as they are not only monociliated but polymorphic from the commencement, they may be assumed to have enclosed after they had become developed from the purified protoplasm.

The fact of portions of the protoplasm enclosing the chlorophyll for the starch it might contain, had been seen by the author most satisfactorily, in some spores of *Spirogyra*, which were in the anomalous state of being pregnant with grains of starch *without* chlorophyll, while their contents were undergoing the transformations above described. Here there was no colouring matter to impede the view, and the author had repeatedly seen the disappearance of the starch-grains directly followed by the appearance of oil-globules; the dividing up of the protoplasm into portions each containing oil-globules, and a gradual lessening in quantity of the oil, indicative of its having become assimilated; while the transparency of the spore generally, enabled the observer to see, that the whole of these transformations were effected, not by any foreign organism, but by the protoplasm alone.

It was true that the transformation of the protoplasm of the cell of *Spirogyra* and its movements above detailed, were unlike the phænomena of vegetable life, but the formation of the spore itself in the normal way, and the movements of the protoplasm of the conjugating cells just preceding it, merely required to be studied to bring about the conviction, that one was but a modification of the other.

In the normal way, the protoplasm of both conjugating cells after having become pregnant with starch, (for nutriment during their uterine life as it might be termed,) combined, two cysts formed around this mass, the starch passed into oil, and finally the filament was reproduced without the presence of either,—living as before by endosmosis. In the abnormal way, the chlorophyll died, two cysts were formed around the portions of protoplasm respectively, the starch passed into oil, the refuse of the chlorophyll was thrown off from the enclosed protoplasm in the manner of a Rhizopod, the protoplasm divided up into Monads which came forth as animals, that is, in the form of Rhizopods endowed with the power of locomotion and polymorphism, and thus under a form which does not live by endosmosis, but by the enclosure of crude material from which the nutriment is abstracted by a digestive process, and the refuse finally discharged.

Lastly, the author stated, that whenever a mass of filaments of *Spirogyra* underwent these transformations, the latter were invariably followed by a numerous development of *Actinophrys Sol* of all sizes, to the exclusion at first of almost all other animalcules; and coupling this with the undistinguishable form from *Actinophrys Sol* assumed by the Monads developed by these transformations, he saw no other more reasonable conclusion to come to, than that they were one and the same, and therefore that one source at least of *Actinophrys Sol* was the protoplasm of *Spirogyra*.

Mr. Carter added that these phænomena were easily witnessed,

since it was merely requisite to place a mass of the filaments of *Spirogyra crassa* about to conjugate, in a basin of water, and then watch the changes above mentioned, which would be sure to occur in many of the conjugating filaments; but of course, to be understood, they required a practised eye, or to be pointed out by a person conversant with the subject.

ZOOLOGICAL SOCIETY.

May 13, 1856.—Dr. Gray, F.R.S., in the Chair.

Some remarks on Crustacea of the genus Lithodes, with a brief description of a Species apparently hitherto unrecorded. By Adam White.

The group *Lithodes*, founded by Latreille upon our well-known, though not very common, spine-covered, empty-bodied *Lithodes Maia*, begins now to become better known. Of the excellent figure of this type of the genus, published by Dr. Leach in his 'Malacostraca Britannica,' it is sufficient to say that it was drawn and engraved by the late James Sowerby, F.L.S., and coloured from his pattern.

A very young specimen, procured by R. M'Andrew, Esq., F.R.S., during his late Norwegian cruise, shows that in the young state the asperities are rather sharper, and the carapace is decidedly longer in comparison with its breadth, than in the adult state; the arrested development of the pieces forming the tail is characteristic in the adult as it is in the young specimen, 1 inch long, dredged by Mr. Barrett, and presented by Mr. M'Andrew to the Museum.

Seba (vol. iii. pl. 22. f. 1) has figured a specimen with longer and more divergent terminal horns to the rostrum. As a bad specimen exists of this variety in the Paris Museum, Prof. Milne-Edwards fancies, and with good reason too, that it may prove a distinct species; he has provisionally named it *Lithode douteuse* (Crust. ii. 186); at all events, it is a variety which research may find in this country, for different specimens differ in their degrees of divergence in the horns of the rostrum.

Haan, in his 'Fauna Japonica,' 217. t. 47, has figured the male of *Lithodes Camschatica*, a species first described as *Maia Camschatica* by Tilesius in the 'St. Petersburg Memoirs,' v. p. 336. pl. 5. & 6, the female (1812). This species is named by the Chinese *Sima-gani*—that is, the Insular Crab.

Tilesius tells us that it is found on the shore of Kamschatka, among the rocks, where it conceals itself and keeps sedentary, living upon cuttle-fish (*Sepia octopodia*), and snaring Starfishes and Mollusca. He records that this *Lithodes* fixes itself so firmly and resolutely in a hole of a rock, that you could not draw it out without breaking its shell. He compares the tenacity with which the Lithodes is held in the hollow of the rock to the fixedness of the *Echinus mammillaris*.

The same learned naturalist has figured another large species from Japan (218. t. 48) as the *Lithodes hystrix*; it is one which Siebold, in